DRiVER

JANUARY 1980

SNOWMOBILE basics

DOUBLE TECH

SELF-RESTRAINT REVISTED

TIM WILLIAMSON

THE BACKYARD MECHANIC

DRIVER

SNOWMOBILE basics

There was once an old radio show, later translated onto television, called "Sergeant Preston of the Yukon." As some of you out there probably remember, it featured a valiant member of the Royal Canadian Mounted Police in the 1800s who went around catching all the "enemies of the Crown." A lot of the time, the action was set in the winter and Sergeant Preston traveled around the countryside on a dogsled pulled by a team of huskies, led by that stalwart canine, Yukon King.

We don't know if he's still up there chasing Lucky Pierre or somebody, but if he is, we think he'd have an easier time catching the bad guy if he left King at home and got a snowmobile.

The nylon tops of the boots can keep the snow out, and the rubber soles give you some traction.

These boots are the hot setup for snowmobiling, and "hot" is much better than "cold" with 27 inches of snow on the ground.

There are a lot of those vehicles whizzing around today, and they enable their drivers to go places only Sergeant Preston would have dared some years ago, and a lot of places the mountie might have avoided. Depending on your duty station, you might get a chance to try driving a snowmobile, so let's get acquainted with them.

Basically a snowmobile is a motorized sled. Horsepower replaces "dogpower"—a gasoline engine drives the snowmobile, by means of a track rather like a tank tread. The engine is in front, covered by a cowling with a windshield. The seat is at the back, on which the driver sits as he would on a motorcycle. In front, underneath, are two steerable skis which are controlled by a set of bike-like handlebars.

Although the vehicle is designed for snow travel, that doesn't mean it's slow. Some snowmobiles can travel 60 mph and more. This definitely takes you out of the Flexible Flyer group.

A chilling thought: Because of this speed, a winter-time problem called "wind chill" becomes important. We don't mention a lot about wind chill in DRIVER's winter articles because in a car you have a controlled climate. But the snowmobiler has more in common with the motorcyclist who goes riding in winter.

Let's look at an example. The temperature outside is 20 degrees Fahrenheit and there's no wind. Not too bad if you have your coat and earmuffs. Now you get on a snowmobile and take off at 15 mph. The wind in your face created by your motion has created a wind chill equivalent to −5 degrees.

continued

Here, we give you a few tips on these machines by comparing them with the transportation of an old hero of ours.

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JAN

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THE EDITOR SPEAKS
DOUBLE CLUTCH

WOW! I COULD'VE HAD A V-8!

Another stronghold of the American V-8 engine bit the dust Nov. 30, when the Buick foundry in Flint, Mich., poured its last of the famous block castings. Although it was the last block poured, V-8 assembly at Buick will continue through April.

With increased emphasis on economy and ecology, the days of the smooth, powerful V-8 engine seem numbered. American Motors no longer offers such power plants.

Since 1952 V-8 and Buick have been virtually synonymous. Once the mainstay of the Buick line, production is currently at 500 V-8s and 3,200 V-6 engines per day.

The love affair with the V-8 began in 1932 when Ford introduced its famous flathead. Another wave of the future came with Cadillac's overhead valves in 1949. Then came a real shot in the arm when Chevrolet started its V-8 production in 1954.

Will the V-8 go the way of the large American sedan? If you think of the full-size car as "dead," then the answer is, "probably not." However, if you're thinking "down-sized" when picturing the "big" car of the future, then you more than likely have the new V-8 image. In addition, manufacturers such as Ford are re-thinking the entire combustion chamber and fuel flow specifically to keep the V-8 alive and pumping.

Yet these facts don't change the passing of an age—the last of approximately 13.5 million Buick V-8s. The final block will be on permanent display at the Alfred Sloan Museum of Transportation in Flint.

At 35 mph, the wind chill is down to −20. Add a real mother-nature-type wind and the situation becomes even more uncomfortable. Check the wind chill chart in this article for all the figures.

Now listen up, because we didn't tell you those interesting facts for our health, but for yours. Specifically, if you go out on a snowmobile without proper clothing you'll risk freezing your buns off. We're not kidding. Ski clothing, although fine for skiers, is inadequate for snowmobilers, because the latter are travelling faster (usually) and moving their bodies less (usually) to do so.

The proper clothing is the one-piece (or two-piece) snowmobile suit. These are insulated and water-resistant, and they'll provide optimum protection against the cold, Also, they are not heavy and they don't restrict movement, like Sgt Preston's fur parka probably did. Thermal underwear and socks underneath are a must, and insulated mitts and insulated, waterproof boots will complete the wardrobe. There are special snowmobile boots with nylon tops and drawstrings to keep the snow out, and felt liners to keep your toes warm.

Here are a few required items for safe snowmobiling: A helmet, tinted goggles, insulated mitts and a spare drive belt.

Now about your head and face: A stocking cap or ski mask is a good idea, along with a helmet (a "must") with a face shield, or at least goggles. The tint of the face shield or goggles is important for adequate vision. Green is best for riding in sunlight. Yellow is for dark days or when the light is flat and hides rough snow surfaces. And at night, only clear lenses, of course.

Controlling influences: But back to the machine. Despite the fact that your sled is more complicated than Sgt Preston's, the controls for it are still pretty simple. There's the throttle on the right handlebar (which probably corresponds to the mountie's whip). There's the brake lever on the left handlebar (for which the good sergeant had to shout "Whoa, King!"). You also have a choke for easier starts (Preston would've had to kick the huskies in the tail), a light switch for driving at night (we don't think Preston went anywhere at night), and an engine kill switch for emergency stops (the sergeant would've had to use his service revolver for "killing the engine").

While you're familiarizing yourself with the snowmobile, whether you're shopping or just renting one at a ski area, there are a few other things you'll want to look at. We'll just give you a few pointers – your dealer/renter will provide you with more detailed information.

You'll want to raise the engine cowling to get a look at the powerplant. Snowmobiles are powered by (relatively) small two-stroke engines. Remember that any engine loses power with greater altitude, so choose a more powerful model if you'll be riding in the high country.

Also, know the location of the spark plugs and how to manage them. And know the proper tension on the drive belt and how to change belts.

Although they are simple to operate, you might be wise to look for a little instruction if you're new to snowmobiling. There are "snowmobile clubs," like ski clubs. Some military bases, especially those in the northern part of the country, have their own clubs. Also, AFR 215-1 has a chapter on snowmobile clubs and safety tips on riding and what to carry. Look it up.

Driving basics: Driving a snowmobile isn't difficult. You use the throttle to go, the brake lever to stop and the handlebars to steer. But that sounds like "It's simple to drive a car. You use the accelerator to go . . ." Obviously there are other things to know.

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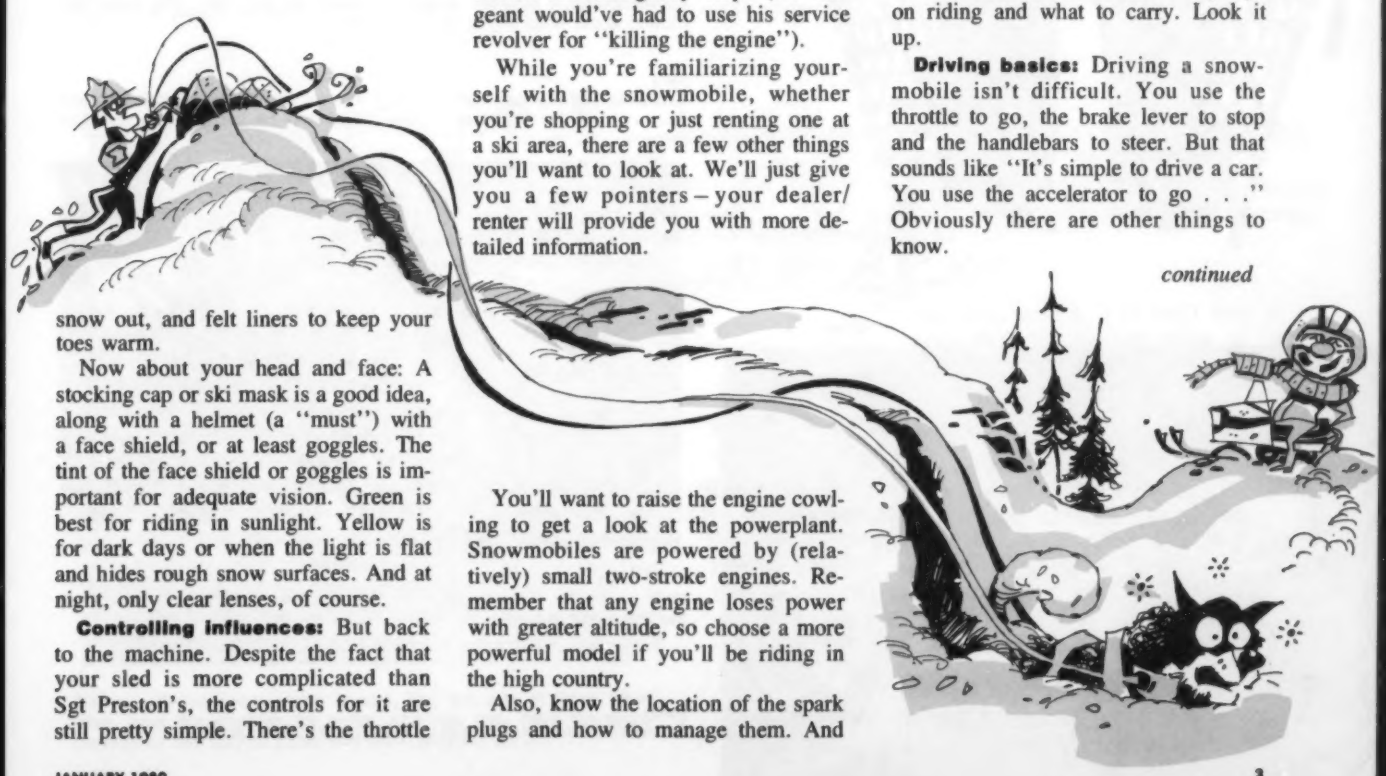
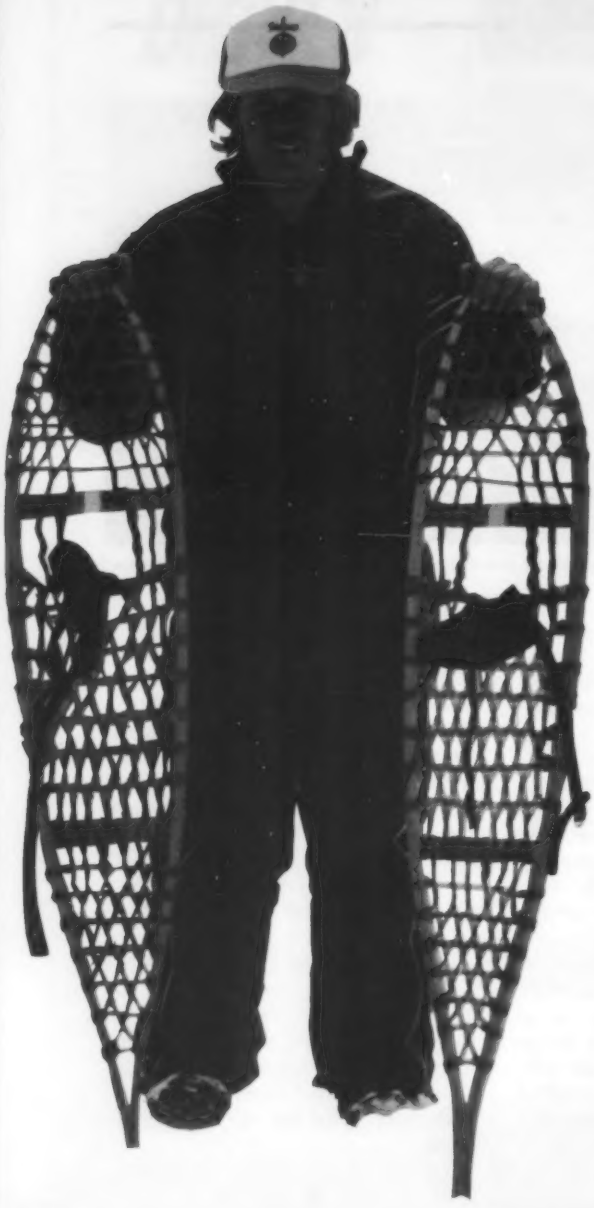




Like: It's easy to go in a straight line; it's more difficult to turn. The faster the machine is going, the more effort it takes. You have to lean *into* the turns, and the faster you go, the more difficult turning becomes.

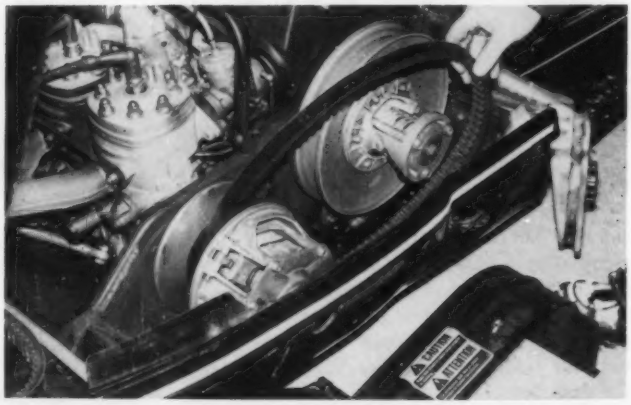
The trick is to keep the snowmobile's track in contact with the ground at all times. Without the track, you've got nothing to keep you going. Also, if the track isn't on contact with the snow, it could be evidence you're about to tip over—an easy maneuver on a snowmobile, with its high center of gravity.

You also have to lean when you're going across the side of a hill, rather than up or down. When you go up or down a very steep hill, you should zigzag across the face of the hill rather than trying to assault it with speed and daring. Remember we said these things like to tip over.

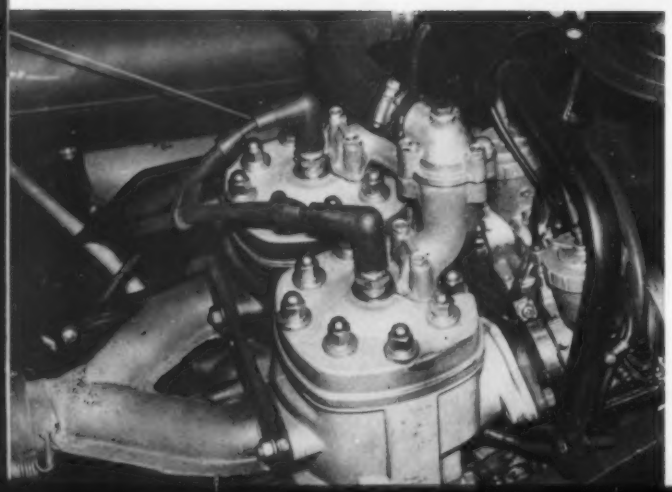
There are three positions for the driver of a snowmobile. The most common you'll use is the seated position, just as a motorcyclist rides his machine.

An insulated suit, either one-piece or two-piece, is the best wear for snowmobiling. It provides adequate warmth for the rider, who does little moving about while engaging in his sport.

(left)
Another safety device: A pair of snowshoes. If your machine breaks down, or you get inextricably stuck, these may be the only way you can get out.



This belt connects the engine to the track, and it is as vital as the chain on a motorcycle. So carry an extra belt. And don't run the machine without the belt shield in place.



(left)
Snowmobiles are powered by small two-stroke engines.

It allows you freedom to lean left or right into the turns. It's a good idea to keep your feet close to you on the running boards so you can raise up if you suddenly hit a bump. Snowmobile seats are well padded, but jolts like that can hurt just the same.

Another position is standing. This is used mostly on hills. When you're climbing a hill, standing will make it easier for you to throw your weight forward to keep the snowmobile from pivoting on its rear sprocket. (Descending a hill, of course, requires careful use of the brake.)

The third position is kneeling with one foot on the running board and the other knee (doesn't matter which) on the seat. This puts your body's center of gravity higher and makes it easier to shift your weight to one side or the other.

Tips from the mountie: A couple of the techniques of our mountie friend remind us of a couple of techniques for the snowmobiler. One is dismounting to get the sled going. Preston had to push a little to help his huskies when they started, and when they had to go up a steep hill. Your snowmobile will have the power necessary to start and keep going, but it might be necessary for you to hop off and work the throttle if the sled gets bogged down in deep (or loosely-packed) snow, perhaps going up a hill. Remember to go slowly. If you give the throttle too much of a twist, the machine will jump away from you and then stop; and you'll be left behind with a faceful of snow, or worse.

The other technique we remember is turning the sled on its side. Sgt Preston did this when he stopped, to keep King and the other dogs from running away with it. You don't have to worry about the machine taking off on its own, since the throttle won't work unless you're there to operate it. But it's good to turn the thing on its side occasionally to *keep* it going. This is what we mean: Occasionally, the track underneath may get clogged up with crusted snow and may freeze up. The remedy: Tilt it over and run the engine. This will throw out all the built-up ice and snow and make the track free-moving again.

Speed and other drugs: No, not that kind of speed. We're talking about "haste; rapidness of movement."

continued

ESTIMATED ACTUAL THERMOMETER READING (°F)

WIND SPEED IN MPH	EQUIVALENT TEMPERATURE (°F)											
	50	40	30	20	10	0	−10	−20	−30	−40	−50	−60
calm	50	40	30	20	10	0	−10	−20	−30	−40	−50	−60
5	48	37	27	16	6	−5	−15	−26	−36	−47	−57	−68
10	40	28	16	4	−9	−21	−33	−46	−58	−70	−83	−95
15	36	22	9	−5	−18	−36	−45	−58	−72	−85	−99	−112
20	32	18	4	−10	−25	−39	−53	−67	−82	−96	−110	−124
25	30	16	0	−15	−29	−44	−59	−74	−88	−104	−118	−133
30	28	13	−2	−18	−33	−48	−63	−79	−94	−109	−125	−140
35	27	11	−4	−20	−35	−49	−67	−82	−98	−113	−129	−145
40	26	10	−6	−21	−37	−53	−69	−85	−100	−116	−132	−148

(Wind speeds greater than 40 mph have little additional effect)

LITTLE DANGER (for properly clothed person)

INCREASING DANGER

GREAT DANGER

Danger from freezing of exposed flesh

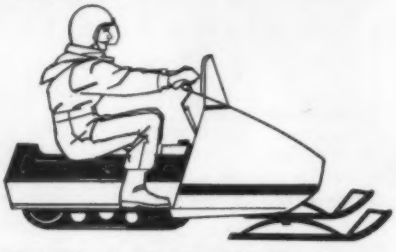
Some winter recreation areas, like this one at Brian Head, Utah, have snowmobiles for rental, and they may have the proper clothing for rent too, for those who aren't properly attired.

Excessive speed on a snowmobile is not a good idea. Speed makes maneuvering more difficult, and it increases the chances you might hit an obstacle hidden in the snow that you might have avoided at a slower speed. Also, if you do take a spill, you'll hit the ground with a lot more force.

The same goes for jumping over things on a snowmobile: Not a good idea. Besides the above-mentioned problems, it is very hard on the machine—to say nothing of your bod. Exhilarating, it may be; bright, it is not.

As for that other drug . . . Unfortunately, winter sports seem to bring out a lot of the elbow-benders. You know, the ones who think they can ski or skate (or snowmobile) better after they've had one or two (or six or eight) drinks. The old "I'm more relaxed" or "I feel warmer" arguments that you hear a lot. Well, we've said it before so you know we're about to say it again: Alcohol dulls your abilities at the same time as it relaxes you (and you only *feel* warmer; you're really not). So you feel good, but perform badly. If you want to be relaxed, try practicing until you are proficient. If you want to be warmer, get some long johns and woolen socks.

The controls and gauges on snowmobiles are very simple. Driving them is also simple—and fun, too.



RIDING POSITIONS

Make sure you start out any trip with a full tank of gas—you never know when you'll need it.

Preparations: Just think how much easier you have it each time you start out on your snowmobile. Every morning Sgt Preston had to clear all the newly fallen snow off his sled, feed his huskies their whale blubber (or whatever they eat), and then harness each one to the sled. . . . Yes, you've got it easier with the machine, but there are still things to check out each time before you push off.

Check the condition and tension of the drive belt. It is the connection between the engine and the track, sort of like the chain on a motorcycle.

Make sure the track is clear and moves smoothly, that it isn't frozen with ice. As we said before, to clear it, tilt the snowmobile on its side and run the engine.

Test the handlebars to see that they turn the front skis easily.

Clear off the running boards. Your feet will need a sure grip for maneuvers.

Check the fuel. It'd be pretty dumb to start out and have to hike a half-mile back to the lodge because you forgot to fill the tank. Always start your journey with a full tank.

And check to see that the throttle and brakes work correctly—that is, when your hands are using them and only then.

Snowbound: You might have the experience of a breakdown sometime.

Keep your feet back toward your body when you're sitting. That way, you can raise up quickly to absorb some of the shock if you hit an unexpected bump.

Turn the snowmobile on its side like this occasionally and run the engine to throw out crusted snow and ice.

After all, snowmobiles have a hard life and they take a severe beating. But you can be prepared with a few tools and spare parts. Here's a list of the minimum you should carry. A spare drive belt. A couple of spark plugs and a plug wrench. Some repair links for the drive chain. A pair of pliers. A screwdriver or two. A flashlight and some flares. A first aid kit. A tow rope. Some matches in a waterproof container (NOT for checking the gas tank!)

continued

SNOW-GO

A few assorted snowmobiling tips

- Know the limits of the machine and ofeed
- Know the limits of the machine, and of yourself. Don't exceed those limits or you're asking for trouble.
- Always ride in a group (at least two) and always stay in sight of the others.
- Carry enough spare parts and tools to handle breakdowns.
- Always start off with a full fuel tank. As part of "planning for the unexpected," carry spare cans of gas and oil when going on long trips.
- If your snowmobile has an electric starter, know how to start the engine by hand should it have an electrical failure.
- Practice handling the throttle of the machine. Snowmobiles accelerate quickly; keep the speed down.
- Remember you're on a snowy surface and don't lock the track when you brake. You know what locking the wheels on your car will do.
- Never travel close to another snowmobile, and especially don't tailgate.
- When you're snowmobiling at night always check out the lights before you start, and carry a good flashlight along. Drive more slowly at night, keeping in mind hazards are harder to see.
- If you're leading a group that's going out on a trail, make sure you know the trail before you go. Give someone the task of watching for anyone who stops or gets stuck.
- When crossing roads, remember the auto traffic has the right of way. Use a spotter to signal when it's safe to go, and then cross one at a time at right angles to the road.
- Don't cross rivers or lakes unless you absolutely have to and are certain the ice is thick enough to support your machine and you.
- When you're breaking a trail, watch for barbed wire fences and utility pole guy wires.
- Better yet, stay on the marked snowmobile trails. They have been selected, surveyed and marked for your enjoyment, convenience and safety.
- Stay off ski trails and automobile roads.
- Take a rest stop at least once an hour and move around to warm up your arms and legs. Check the machine over at each rest stop.
- Know how to recognize and treat frostbite.

continued

And one other thing that'll *really* make you feel like a mountie—a pair of snowshoes. You heard right. If your machine breaks down and there's no way you can get it going again, you may have no option but to walk out. The snowshoes will make the task much easier and faster.

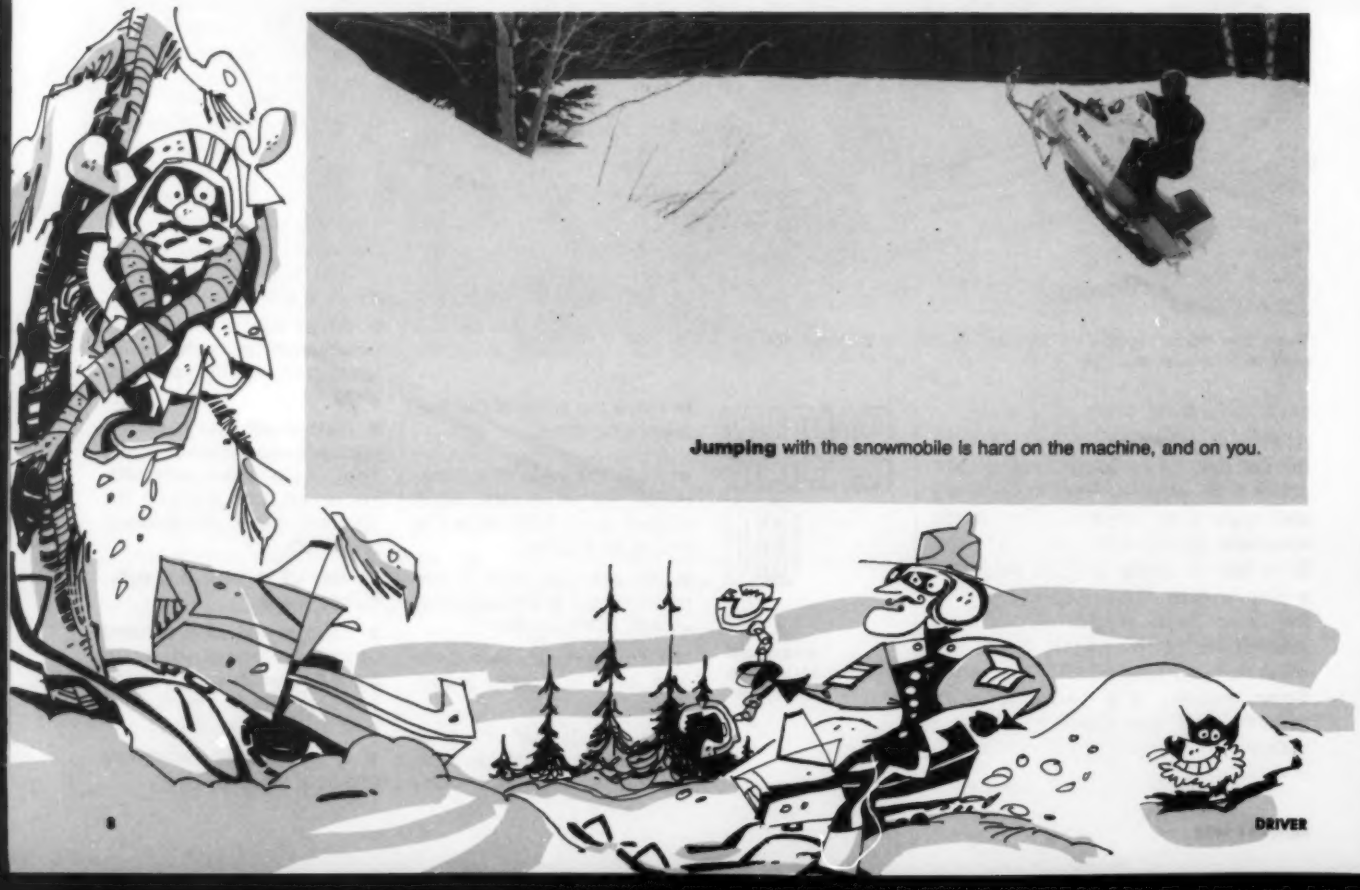
In defense of dogs: We've spent all this time telling you the advantages that you, with the motorized sled, have over the TV mountie, with his dog-sled, but we don't want you to get the idea that we dislike dogs. So here are some of the advantages of dogs over snowmobiles.

A dog will run after a stick for you and will come when you call his name; a snowmobile will just sit there. A dog will lick your hand and give you warmth and love; a snowmobile will growl a lot when you make it move. A dog has personality; a snowmobile smells like gasoline and oil.

We hope that sets the record straight. We like dogs much better. But for winter transportation, give us a snowmobile any day.

When you make a turn, lean into it to keep the snowmobile's track in contact with the snow.

Jumping with the snowmobile is hard on the machine, and on you.



SELF RESTRAINT REVISITED

A few months back we gave you the chance to tell us what kind of passenger restraints you prefer in your car ("Self-Resistant Poll," March 1979 DRIVER). Very few of you responded, only 60 in fact. However, about 2,000 readers have so far responded to a readership survey we did in the summer. Because there were questions about safety and seatbelts in that survey, we decided to compare its results with the "Self-Restraint Poll."

One thing has happened since we did that poll that we heartily applaud – the automotive industry abolished the terms "active" and "passive," with reference to restraint systems. These terms were confusing at best. At least one respondent to our poll had the two terms confused, calling those belts that you buckle yourself "passive." The new terms, by the way are "manual" and "automatic," which are much easier to understand. We'll use those two words in this discussion.

First, those who responded to the poll:

Q#1: *What kind of restraint do you prefer and why?*

Forth-eight people (80%) liked the manual (buckle-it-yourself) belts, six (10%) liked the automatic belts, two (3%) preferred airbags, three (5%) wanted some combination of systems, and one (2%) stated simply that he wanted "none."

Here are a few assorted reasons for their preferences. Of the manual belt advocates, the most common reasons given were: "They help keep me in position while maneuvering and thus help me control the car," "I have a choice about using them," and "They're easy to use and comfortable." One of the most interesting comments was "They do not lull me into feeling that my vehicle will take care of me."

The automatic belt people said "They're more convenient and you won't forget them," and "They will be used all the time."

The only comment from an airbag advocate was that "They are the most effective method."

A manual-belter commented he would like automatic belts on the passenger side for a carpool passenger who refused to buckle up (the passenger out-ranked him!).

Q#2: *Why do you not prefer the others?*

The pro-manual belt people were outspoken in their opposition to bags. Most common: "Bags won't protect you in a side collision." "Bags offer no protection in a rollover." "I resent the cost of the bags, and I resent the drivers who don't wear belts and therefore cause the government to develop things like airbags." "Bags should be an option, not mandatory." "Bags give no protection in multiple-impact collisions." But by far the most common reason given was "I don't trust airbags – they might not work in a collision, and they might deploy at the wrong time."

Several people gave this interesting point: "With airbags you have to wear seatbelts also for full protection, so why have the bags at all?"

The pro-automatic belt people commented: "I don't use the manual belts on short trips" and "You have to remember to buckle the manual belts."

Q#3: *What kind of restraints are in your present car?*

Fifty-five people had the manual belts, one had automatic belts, one had one car with manual belts and one with automatic, and three gave no answer. Nobody had airbags.

Q#4: *If you have the regular active (manual) belts, do you use them? If not, why?*

Fifty-four said yes (three said just "part of the time"), and one said no. The part-timers said "I forget sometimes," "I'm in too much of a hurry." "I'm not concerned on short trips, because of the low speed." The non-user said "I only wear the belts when the SPs are doing a belt check."

Q#5: *If you have passive (automatic) belts, have you left them connected? If not, why?*

Both of the automatic belt owners had left them connected.

Q#6: *If you have airbags, have they ever been used?*

Nobody had airbags.

The most likely respondent to this poll seemed to be a captain from SAC, between 26 and 40 years old, who drives a domestic car.

"Got a minute?" We took a small handfull (357) of the cards from the readership survey to examine for figures on seatbelt usage. Based on this sample, 55 percent of the respondents to the survey wear their belts all the time. 39 percent some of the time and only 6 percent never wear their belts.

As we told you when we did the "Self-Restraint Poll," it is not a scientific poll and we can't conclude very much from the results. However, we think it's safe to say there are people out there who are angry about the move toward the airbag and are glad Congress has postponed it. (An airbag survey done recently by *Road & Track* very clearly underlined this fact.)

To those who responded to the occupant restraint poll and to the readership survey, our thanks. Your comments were well thought-out, and we have found them helpful.

If it's a *Cadillac* This must be .... *Miami*

Some time back DRIVER had a continuing feature we called "Where's Joe?" It was a little quiz in which we gave you a picture or drawing of some geographical location a military member might find himself in and you had to guess "Where's Joe?"

This is also a test of your knowledge of places, but with a difference. Instead of some of the landmarks or tourist attractions, all we'll give you are the kinds of autos you'll see. All these places are within the U.S.

1. The car is a beat-up 1965 VW van, coughing out black smoke (some even from the exhaust), complete with numerous ecology bumper stickers.

2. The car is a 1980 Cadillac (either white or gold) with steer horns above the grille.

3. It's a '74 high-riser pickup with a gunrack (empty) and a cupholder for beer cans attached to the dashboard (full).

4. There are two most-common vehicles. One is a gray 1967 Volvo with no piece of straight metal on it and all four wheels misaligned from hitting potholes. The other is a yellow Checker with police pusher-bumper, complete with gray Volvo paint.

5. The car is a Buick 225 (any year) with rust spots on the bumpers and around the wheel wells, creeping farther and farther onto the fenders.

6. Several different ones here: A shiny low-rider, either a 1967 Chevy Impala or a 1975 Buick Riviera. A 1972 Chevy Malibu hi-jacker (in dull primer-paint gray) with aluminum hood scoop that obscures one-third of the windshield. And a late-model 280-Z (or brand new 280-ZX) that gets paste-waxed every other day.

7. On this car, the make varies – whatever Richard Petty was driving that year, that's what this one is. You can hear it for minutes before you can see it, because of the *high* performance engine, and it looks sort of like a hi-jacker.

8. Here, it's either a very old Saab or a brand-new Porsche 911 with a ski rack. The skis on the rack have never been used – and probably never will be.

9. This area is overrun with Subarus – all colors, all models, all years.

10. All the cars have out-of-state license plates, and they're all together. You know when you're going to see them. Just look for the state patrol spotter plane circling overhead and they'll be just over the next rise – 87 cars with one black-and-white that just pulled them over.

11. Here, a black-and-white police cruiser (with two-way radar) is the *only* car you'll see.

12. Again, there are several. A 1976 "Urban Cowboy" four-by-four with 10 lights on the roll bar and six more on the bumper, and two eight-foot aerials. A 1964 VW station wagon that looks like it's been rolled at least once. A 1978 280-Z that sports a ski rack – all year.

13. Whatever the most common car is in this place, it went by too fast for us to see it.

14. The car is a 1977 Oldsmobile with no rear shocks.

15. It's a $17,000 custom van that never moves from its parking place, for lack of money for gas. It's a 1978, but was bought recently brand-new from the dealer who gave a "special discount."

Answers:

By now you realize we've been putting you on again, but we hope you've had some fun with it. We tried to be fair (that is, nasty to *everyone*), but we probably missed a few stereotypes. Write and tell us if you have any favorites we overlooked.

1. This is Boston, where else?

2. Houston. This one was probably obvious.

3. This one was tougher. It was designed to describe the "greater Southwest," but it probably applies to the Midwest and Texas and South Dakota and . . . As for the beer can, the driver oughta be ashamed.

4. New York City. A dangerous place for *any* car.

5. This car's condition is commonly called "Michigan cancer."

6. We picked several because we know this best – it's Southern California. But the 280-Z probably rates number one.

7. This is the Southern States Mountains car. It only *looks* like a hi-jacker because the moonshine tanks were empty when we saw it. (See? We watch "Dukes of Hazzard," too.

8. This is New Hampshire or Vermont.

9. Eastern Washington.

10. Kansas.

11. Oklahoma.

12. Colorado.

13. Nevada.

14. Cleveland.

15. Sorry, but it's any airman's dorm at any base in the U.S.

If you want to score this test, use the following scale.

0-4 right: Pitiful. Either you have no sense of humor or you'd better start paying attention to the other cars on the road. Some of them have *lousy* drivers.

5-8: Better, but still not too inspiring. Keep working on it and you may become mediocre.

9-12: You have possibilities as an observer, but Sherlock Holmes has nothing to worry about.

13-15: Have a cigar. With effort you could become crazy enough to work for DRIVER.

save by sharing

There is an average of 1.2 persons in each motor vehicle on the streets and highways of America during rush hour each day, says the U.S. Census Bureau. The Highway Users Federation has estimated that if the average were increased to two people in a vehicle, we could save 250,000 barrels of oil each day, and we could save $4.8 billion a year in commuter costs.

Here are some charts that might bring those figures a little closer to home. Get out your calculator and see how much you could save in a week or a month.

Urban Transportation Fuel Efficiencies
August, 1979

	Passenger Miles Per Gallon
Vanpool (10 occupancy)	87.90
Bus	40.72
Rail (old system)	31.33
Carpool (2.6 occupancy)	22.94
Rail (new system)	19.00
Auto (1.2 occupancy)	10.55
Auto (single occupancy)	8.79
Dial-a-ride	7.25

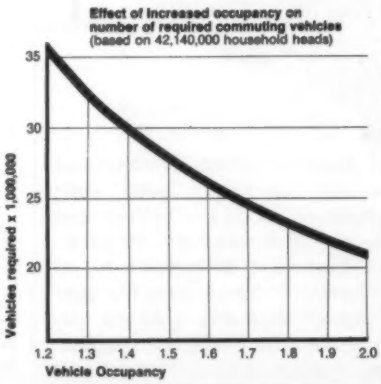
Source: Highway Users Federation

The Economic Cost of Commuting
August, 1979

Travel Mode	Cost per Mile*
Automobile 1 occupant	48.8¢
Automobile 1.2 average occupancy	40.7¢
Rail transit walk access	36.1¢
Rail transit bus access	29.7¢
Bus conventional	23.1¢
Automobile 4 occupants	12.2¢
Van 10 occupants	5.7¢

*Based on prorated costs for a 10-mile, one-way commute in metropolitan areas of over one million population (1979).

Source: Highway Users Federation



Source: Census Bureau, Highway Users Federation

Airman Tex Tile is driving on a cold winter afternoon on a slushy patch of highway. He notices a car stopped on the right shoulder, facing toward him. He decides to slow down and look for a way to go back and help the motorists. He takes his foot off the accelerator and goes into the left lane to stop in the median, but the tail of his car slides to the right. As he steers into the skid to recover control, the car spins in the opposite direction and he slides across all three lanes of traffic and off the road. He applies the brakes only after he leaves the pavement (feeling they will make things worse until he finds more solid footing) and stops halfway down a dirt embankment. End result—a dented oil pan, but no serious damage.

In looking back at his first experience with hydroplaning, Airman Tile should think:

a. "If I hadn't slowed down when I saw that guy off the road, I'd have bought it myself."
b. "I should've pumped the brakes while I was skidding so I could get back in control."
c. "I should have been driving slower on that slick road."
d. "I should have thrown it into neutral the moment I began to skid."
e. "I was doing most everything right; it was just one of those things you can't foresee."

We'll accept "b" or "c." Certainly if he'd been driving slower it wouldn't have happened at all. But when he did begin to skid, pumping the brakes would have helped him straighten the car out.

However, taking his foot off the accelerator as he changed lanes might have *brought on* the skid. And shifting to neutral would simply have made the skid worse. It was *not* "just one of those things." It could have been prevented, and it could have been handled better.

tteecchh!!
DOUBLE TECH Q A

Question: **The "Synthetic Oils" article in the August 1979 DRIVER was very informative; however, I'm left with a few questions. An oil company representative I met at a local air show told me that cars should be "weaned" on to a synthetic rather than given one sudden change. For example, one quart with the first oil change, two quarts with the next and maybe going all the way on the third. I dimly recall him saying something about the better detergent qualities loosening residues too fast. Are synthetic and natural oils mixable?**

Answer: Polyol esters mix with conventional engine oils, fair; diesters good; while polyalphaolefin and alkylbenzene synthesized hydrocarbons mix excellently. However, I do question the oil rep's "weaned" theory since his company doesn't market a synthetic oil, rather an oil with a "plus." Besides, mixing synthetics with conventional oils leaves you following the conventional oil change rate (every 5,000 to 6,000 miles) and you lose one of the better cost-saving factors of the more expensive synthetic.

Q. **Do synthetics provide adequate lubrication to seals or are present gaskets and seals adversely affected by synthetics?**

A. Seal-swelling tendency with typical rubber seal material is moderate with diester; high with polyol ester; light for both conventional and alkylbenzene; and nil with polyalphaolefin.

Q. **What's so special about the filter the synthetic oil companies say should be used before they guarantee the 25,000 miles between changes? If the cost of a synthetic is $4.95 a quart and you put in five quarts that's $24.75. Your article says the cost of oil and filter is $38.75 for 25,000 miles. That makes the cost of the special filter $38.75 minus $24.75, or $14. Wow!!! What's the matter with a normal oil filter at $2.95?**

A. The special filter has an excellent micro rating and will last 12,500 miles between changes. As you know, auto manufacturers recommend changing the filter at every other oil change or 10,000 to 12,000 miles. But, if you're like me, we change the filter every oil change. Which leads us to a minor mistake in your figuring. While the synthetic oil lasts 25,000 miles between changes, the filter is changed every 12,500 miles. This also requires adding an additional quart of oil at the 12,500-mile mark to make up for the one dumped with the used filter. That means the $38.75 cost for 25,000 miles includes six quarts of oil and two filters, not five quarts and one filter. As the August DRIVER article is a reprint from April 1978, the figures are low. Today the special filter costs $6.10. As for the normal oil filter, you'll probably want to change it every 5,000 to 6,000 miles as you did before, or twice as often as the special filter. Now add to that the cost of an extra quart of oil three times during 25,000 miles instead of once, plus the cost of four filters instead of two and see which costs more in the long run. This is not to say you can't use the other filters, but consider the overall cost.

Q. How about a chart showing all the synthetic brands available, their base chemicals and mixability?

A. We'd love to; however, only four manufacturers replied to our original requests. Besides, synthetic oils for general consumers are still a pioneer growth market, with companies coming and going faster than snowmobiles, CBs and video-recorders. The closest I've seen to what you would like was in the October 1978 *Road & Track*. (Back issues available from: Road & Track, Dept. C0017, P.O. Box C734, 524 Myrtle Ave., Pratt Station, Brooklyn, NY 11205. Ask for #10652. Cost is $2 plus 75¢ postage and handling.) By the way, all current synthetics are compatible with both conventional oils and each other.

Q. Assuming I'm not hauling a heavy load across the Gobi Desert or over a mountain, are the performance factors for all synthetics about the same? Could you do a performance comparison study of all the brands?

A. Performance tests are well beyond the scope of DRIVER, and the kind you ask for beyond the capabilities of any magazine I know about. However, the U.S. Army Mobility Equipment Research and Development Command has extensively tested synthetics. They didn't rate one against another, though. They did rate them against standards such as API, SE and MIL Spec. The scale being fail, meet or exceed. To date they all met or exceeded the standards.

Q. After using synthetics, can I go back to conventional oils?

A. If you don't find the performance up to what you expect, can't justify the costs or whatever, by all means change back. No measurable harm has been done. OK?

Q. When switching to a synthetic oil, do I use the same grade such as 10W30?

A. So far the auto manufacturers have all said stay with the same grade. By all means, don't drop below the minimum grade your manufacturer accepts for warranty unless the word "void" thrills you. Which brings up another point: Currently most manufacturers accept synthetic oils as long as you follow their oil change schedule – changing it completely every 5,000 to 6,000 miles. This kills one of the best reasons for using synthetics – the long duration between changes. However, with the EPA allowing synthetics during mile-per-gallon and emission rating tests for the 1980s, there may be a change in this party line soon.

Q. I have one domestic car with 75,000 miles on it that doesn't burn oil (it loses a small amount because of a worn valve stem or guide) and another Japanese model with 54,000 miles that is healthy in every way. I do my own maintenance. Can I switch to synthetic or is it too late?

A. Sounds like the decade-old American bomb could use a good valve job rather than a can of viscosity stretcher. After that and a normal break-in period on conventional oil, it should be able to change its diet much like the foreign vehicle can right now. As long as the vehicle is not using oil, it is never too late to make the switch. In fact, the former DRIVER technical editor (who, by the way, wrote the synthetic oil article) changed his 1966 luxury limo over after more than 80,000 miles.

And if you couldn't tell by the tenor of the article, he's one of the strongest synthetic supporters. A final note of caution: There have been some rumblings about worn production tolerance engines suffering bearing failures under extreme loads while using synthetic oils.

Editor's Note: Double Tech is a question and answer column in which DRIVER will attempt to make clear some of the cloudy subjects in readers' minds. Unlike other automotive magazine Q&A columns, Double Tech won't be dealing with specific questions such as, "Why does my 1959 Gomobile belch smoke first thing in the morning?" Instead Double Tech will be fielding questions that are of general interest to the majority of readers. If you have a question you'd like an answer to, and you feel others could use the knowledge too, send it to:

DRIVER,
AFISC/SEDD,
Norton AFB, CA
92409.

Like most magazines, DRIVER has a large lead time between writing and publication, so don't be surprised if it takes more than 120 days to get a reply.

HOW MUCH IS IT REALLY GOING TO COST?

You've got your new vehicle and options all picked out. The personal sales representative has been working with his calculator and pencil for five minutes. Now comes the moment of truth. He turns the paper around so you and the spouse can see the figures. Previewed with a huge smile he says, "We'll take your old buggy and $6,000."

The price is agreeable so you counter with, "Can you finance that?"

"Easily," you're assured. "How many months would you like?"

"We know the payments would be too high for us at 36, but 48 seems too long – what can you get us?" you sidestep.

Already looking in the book and madly working the computer and pencil the reply comes back, "I can put you in it today for $187.50 over 42 months. How's that sound?"

At this point you should ask pointedly, "What's the APR and our total cost?" No, you don't want an airman's performance report, you want the annual percentage rate.

If you're thinking that the truth in lending laws are going to protect you, you're right. But remember, that bright new vehicle's finish is going to leave you blind to the figures and deaf to the closing individual's words when final paperwork time rolls around. Besides, many people like to figure out where the numbers came from themselves without benefit of the salesperson or a required-by-law quoted amount.

The chart with this article provides a simple way of determining how much interest you're actually paying. What you do is divide the total amount to be financed by the stated monthly payment. Then go across the line for the proper number of payments until you find the figure closest to that number. Directly above the figure will be the annual percentage rate.

Going back in the story, the figures were $6,000 financed over 42 months at $187.50 per month. Divide $6,000 by $187.50 and you get 32. On the 42-month line go across until you find 32.000. This is below the 16 percent column. In other words, a 16 percent interest loan.

Can you get the loan for less interest? Probably, but not being where you are right now, a firm "Yes" is hard to come by. The only way to find out for sure is to shop as carefully for the loan as you did for the vehicle.

Number of Payments	9%	10%	11%
18	16.779	16.651	16.524
24	21.889	21.671	21.456
30	26.775	26.447	26.125
36	31.447	30.991	30.545
42	35.914	35.315	34.730
48	40.185	39.428	38.691
60	48.173	47.065	45.993

The Technical Editor explained this chart as bei

Why shop for the loan money? Because of what it is going to cost over the life of the loan. You'll end up paying back $10,465.40 for that $6,000 loan at 16 percent. If the local bank provided the funds at 12 percent APR, you'd pay back only $9,727.31, or a savings of $738.09. And if the credit union came across with a 9 percent loan, you'd pay them a total of $9,216.24 or another $511.07 above the bank's saving which is $1,249.16 in your pocket from the 16 percent dealer's loan.

But I've never kept a vehicle for the term of the loan, so why bother? Dumb thinking, bunkie! Let's look at the monthly payments first. At 16 percent they're $187.50, while at 12 percent they'll be $175.65 and at 9 percent they are $167.07. That's just the monthly payments. If you decide to trade at the end of the first year (nobody can afford to do that, can they?), and you had a 16 percent loan, you'd still owe $4,611.10. At 12 percent the balance would be $4,533.22 and at 9 percent it would be $4,473.24. So you can get more trade-in, also.

The bottom line? It costs money to borrow money, but don't spend more than you have to. Shop around.

1%	12%	13%	14%	15%	16%	17%	18%	19%	20%	21%	22%	23%	24%
.524	16.398	16.274	16.151	16.030	15.909	15.790	15.673	15.556	15.441	15.327	15.214	15.102	14.992
.456	21.243	21.034	20.828	20.624	20.424	20.226	20.030	19.838	19.648	19.461	19.276	19.094	18.914
.125	25.808	25.496	25.190	24.889	24.593	24.302	24.016	23.735	23.458	23.186	22.918	22.655	22.396
.545	30.108	29.679	29.259	28.847	28.444	28.048	27.661	27.281	26.908	26.543	26.185	25.833	25.489
.730	34.158	33.600	33.054	32.521	32.000	31.492	30.994	30.508	30.032	29.568	29.113	28.669	28.235
.691	37.974	37.275	36.595	35.931	35.285	34.656	34.043	33.445	32.862	32.294	31.940	31.120	30.673
.993	44.955	43.950	42.977	42.035	41.122	40.237	39.380	38.550	37.745	36.964	36.207	35.473	34.761

as being "the Present Value of $1 Received Monthly or $PVIF_a$. It's really a simple formula: $A_{n,r}=\$1\left[\frac{1-(1+r)^{-n}}{r}\right]=\$1P_{n,r}$." Got it?

Tim Williamson

Rookie par excellence

Tim Williamson loves to drive fast—the faster the better. He started going fast when he was young and has never slowed down. However, by National Association for Stock Car Auto Racing standards, he's still young.

He started with karts at age 13. In four years he claimed a Junior Sprint Grand National Championship and almost followed it with a senior title. Having "done everything we could in karts" Tim moved into stock cars.

Starting in limited sportsman cars he met with almost immediate success, winning rookie honors at two tracks in his first year of competition. Three years later found him stepping into late model sportsmen and open competition super stocks. Then people started to really take notice of the young man from Seaside, Calif.

In his first race on a one-mile oval he finished second. Williamson then won his first NASCAR Western Division Grand National event, beating out the 1978 winner of the Daytona and Atlanta 500s, Bobby Allison. Midway through the season he tangled with some of the hottest open competition super stocks in the country on the Riverside, Calif., road course coming away with a fourth place in a car that was supposed to be no match for the more powerful and streamlined Camaros and Firebirds.

Having never seen any of the tracks in Washington and British Columbia, Tim finished third overall in the International Drivers Challenge Series of seven races in 10 days.

At the Sears Point road course in Northern California he was the fastest qualifier ahead of such noted stock car drivers as Bobby Allison, Benny Parsons and David Pearson. He led that even until slowed by battery problems.

Returning to the scene of his first Grand National West victory, Tim set the standard for 99 Speedway in Stockton, Calif., driving the first stock car to break the 14-second barrier on the quarter-mile paved oval to a 13.95 second lap. He led the 150-lap main event there until sidelined by water pump failure.

Then Tim really began to crank on the speed. In November 1978, on his first visit to the 2.5-mile Ontario, Calif., oval, he dominated Grand American competition. After only 20 laps of practice he turned in a record one-lap speed of 155.220 miles per hour. That was in the morning; during the afternoon's 200-mile race he walked over the entire field—not once, but twice. A mid-race pit stop left him trailing by almost half a lap. However, he blasted past the entire pack in only 10 laps.

With that, Grand American competition on the West Coast became a Williamson playground. At the next GA event on Riverside's road course, he survived a blown tire that sent him off course at more than 130 mph early in the event with excellent pit stops to win the race by 10 seconds. He then went three-for-three in GA races by also winning the Grand American event at the June 1979 Riverside race by about two seconds.

However, Grand American competition was only a small part of Williamson's 1979 success story. Having not run more than five Western Division Grand National events in 1978, Tim was eligible to compete for the rookie of the year title. That became another honor Tim won walking away. But this walk almost carried him to the overall Grand National West championship. Finishing in the top 10 in all but two races during the Grand National West season, he led the championship on numerous occasions. Yet, it was those

The start of the Los Angeles Times 500 at Ontario has Cale Yarborough leading into turn one from his pole position. Williamson has already put seven drivers behind who started the race in front of his 33rd qualifying position, although he is buried in the pack, third from the right-hand edge of the photo.

two non-finishes that made more than the difference of five counters between Williamson's 743 points and the champion's 748 at season's end.

To stay in contention for the championship, Williamson had to seek out rides in three Grand National events on the West Coast in which Western division drivers also compete. (The reason for seeking a ride is different specifications for regular Grand National cars as opposed to Western Division Grand National vehicles. Western Division cars have 112-inch minimum wheelbases with a 3,500-pound weight minimum, while full Grand National vehicles must have at least 115 inches between front and rear wheel centerlines and weigh at least 3,700 pounds. To build a special car for just these three races a year is beyond most race teams' financial and physical capabilities.)

In the first race Williamson was ninth and was headed for another top-10 finish in the second when an engine fire put him out of the race. Although he had a good regular Grand National vehicle for the final NASCAR event of the decade, competition was so tough that being left clutchless after the first pit stop meant a 22nd place finish.

Impressive as his record is, everything to date has been just stepping stones. Stepping stones to a top ride in NASCAR Grand National competition on the superspeedways such as Daytona, Talladega, Dover, Atlanta, Michigan International, Darlington, Charlotte and Pocono. And that top ride has already been signed for the 1980 season. Tim will be piloting stock cars for Jim Stacy at major NASCAR events, Stacy's past machines having been some of the fastest to ever tour superspeedways.

Although Tim was a rookie in the Western Division during 1979, he'll be the essence of a "rookie" on the Grand National tour. When comparing Tim's age and number of Grand National races started by the end of the 1979 season to those of NASCAR's superstars, it is evident he'll be stacking his youth against their experience. Tim's just turned 24 and has started three Grand National events in his 10 years of racing. The age/starts figures for some of the superstars look like this: Bobby Allison, 42/466; Donnie Allison, 40/204; Buddy Baker, 39/500; Benny Parsons, 38/325; Richard Petty, 42/805, and Cale Yarborough, 40/404.

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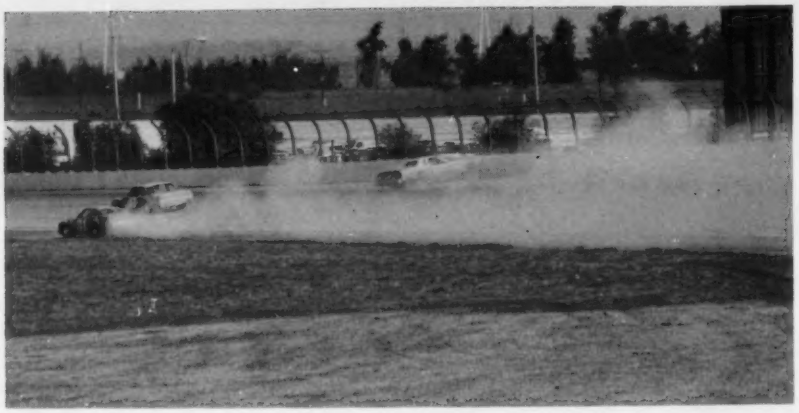
GOODYE
UNION 76

10
THERMASIL

10



BELL

continued

(far left)
Tim discusses race strategy with his public relations representative Chuck Santori before the start of the final NASCAR Grand National event of the decade.

(near left)
Williamson at speed—fast as always.

(far left)
Stock car races are won and lost in the pits where it is routine to get 14 gallons of fuel and two right-side tires in less than 30 seconds. The official pit stop record is 15.977 seconds. No long gas lines here.

(near left)
When racing cars start spinning at more than 125 mph smoke pours off the tires and hides some of the action. The number 40 machine that is into the concrete wall is driven by D.K. Ulrich, the individual who brought along a second car for Williamson to drive at Ontario. At the end of the 500-miler, Ulrich was classified in 33rd position having an engine failure 46 laps after this lap nine incident, while Tim hung on without a clutch to finish 22nd.

(far left)
Tim's office includes a radio in the helmet; however, we don't think it plays his favorite music—although he may sing into the mike from time to time.

(near left)
And when he's at work there's a net to keep him there.

(far left)
The driver must know where he stands at all times during a race. So, in addition to the official scorers above the grandstands, each crew has an individual who keeps track of where the car is on the track, how long it takes to circle the oval and make each stop.

(near left)
It takes more than a driver and pit crew to be competitive. Besides the timekeeper, others get involved during in-race tactical meetings, and still others listen to the official's radio channel to keep track of the overall picture.

Tim is taking the whole youth versus experience bit as a section of the larger pie. "The longer you drive and the more you drive," he asserts, "you're going to get more experience. You are never going to quit learning. I don't care how old you get. I've driven cars only four years, while there are drivers that have probably driven cars 20 years around here. They're bound to know more than I do.

"You've got some drivers who'll drive only so fast. I'll drive faster. They'll know more, but I'll be faster because I want to be faster. They go out for consistency, they just run the race. They have more experience. They might get in a situation where I might get in trouble, but they won't because of their experience. But I'll be faster."

As the record shows, Tim gains experience as rapidly as he drives. He has to in order to be competitive in Western Division late model stock cars. Grand National West races run a full gamut of tracks – tight, flat ¼-mile paved ovals; wide, banked ½-milers; sweeping clay tracks; the super fast surfaces of the mile at Phoenix and 2½ miles at Ontario, and even road racing tracks. And Tim's been in the hunt on all of them.

Tim likes the dirt tracks because those are the surfaces that he learned to race cars on. Similarly he likes the road courses because he ran most of them with enduro karts.

On the other hand, he finds the short, flat tracks in Washington "hard to learn. Besides," he adds, "I prefer a little more banking. With banking you can go faster. I like to go faster than most people."

As surprising as it may seem to some people, Williamson found that his karting experience paid off. "On short tracks I race with two feet," Tim points out, "and all a kart has is two pedals.

"Then all karting is road racing – really tight racing, bumper-to-bumper. This helps on road courses, short tracks and super speedways. Because you are running bumper-to-bumper. You really have to be able to judge distances. You need to know how close you can run in on somebody; how close you can really get. On karts," he explains, "you can actually see how close you are and this helps develop depth perception . . . you have to have depth perception in the cars to run that close."

Tim's ability to adapt as evidenced in West Coast races also shows in his one trip into the heart of stock car racing country – Daytona International Speedway, Fla. Using the same vehicle that turned heads during the Grand American race at Ontario in November 1978, Tim qualified seventh fastest on the first day at the speedway with a speed of 185 mph. This becomes a feat when considering that Tim turned that speed after only five laps on the high-banked tri-oval. By the end of the week he was turning laps at 193 mph to be the fastest car on the track.

At the start of the race he quickly moved from his seventh starting position to fifth. Then he took fourth place from NASCAR superstar Darrell Waltrip and was closing on third place runner Neil Bonnett when his inexperience caught up with him. Coming into

continued

DOWNSIZING

Following the automotive industry trend to downsize, NASCAR is in the process of establishing new wheelbase, cubic inch, minimum weight, body height, carburetion, etc. rules for 1981 competition. The 1981 Grand National stock cars will have approximately a 110-inch wheelbase, with V-8 engines of between 300 to 325 cubic inches (although rumors of super-hot V-6 set-ups flow daily) and minimum weight requirements between 3,300 to 3,500 pounds. Potentially eligible 1979-80 models for the '81 season include: Buick Regal Coupe, Chevrolet Monte Carlo and Malibu, Chrysler LeBaron, Dodge Diplomat, Ford Thunderbird and Granada, Mercury Monarch and Cougar XR7, Oldsmobile Cutlass Supreme, and Pontiac Grand Prix and LeMans. The eligible 1981 models will of course be determined after the manufacturers announce their lines for that year.

continued

the pits much too fast, the car ran over some compound put down to dry up spilled oil, spun into the pit wall and out of the race.

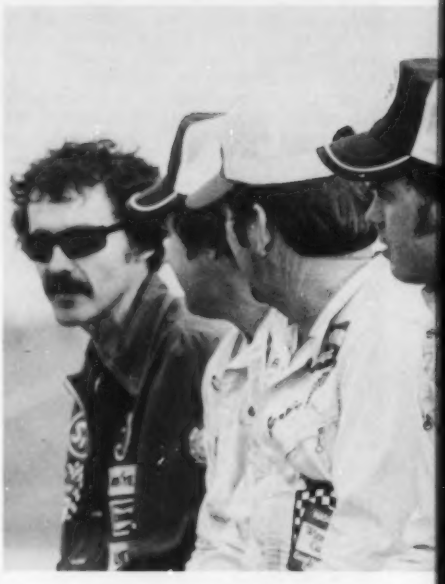
The final results all come back to experience. The young driver tries something, gets in over his head because he's not used to it, and ends up crashing and wrecking the car. Some even get hurt.

But because of safety standards in NASCAR, very few get hurt. As Williamson sits in a stock car there is more than 200 feet of seamless steel tubing forming a roll cage around him. The belts and straps that go around his waist, come over his shoulders and even up between his legs to keep him from moving around in the vehicle are each three inches wide, not two inches wide like your belt/harness. There's a net over the window to keep his helmeted-head inside the safety-plane of the roll cage. There are three metal bars inside the windshield to keep it from getting blown in on him.

The car is equipped with bigger wheel hubs, spindles, wheel studs and bearings to take the higher speeds and stresses of the corners. There are huge disk brakes on all four wheels to slow the car down. There's even an onboard fire extinguisher that can put out almost any onboard fire by simply pushing a button.

Furthermore, the officials are looking out for the safety of all the participants. Tim says it's as if they were going to be driving the cars themselves

Tim learned to race cars on dirt and it shows in his form on the clay surface at Ascot.



(right)
Tim will be keeping fast company in 1980 as he races regularly with this group of NASCAR superstars. That's reigning NASCAR Grand National champion "King Richard" Petty at the far left.

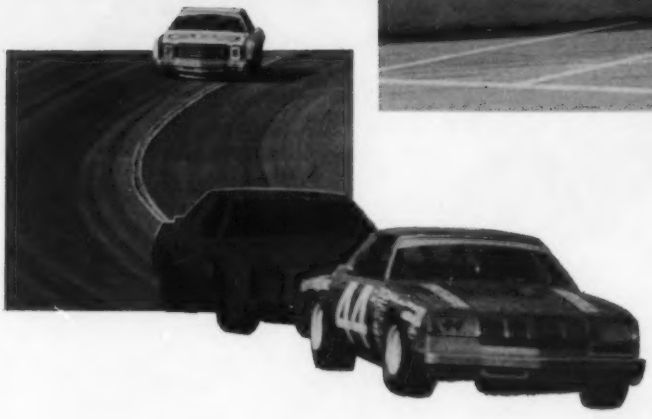
—they'd want to be safe from harm. "While they might overlook a minor item such as the body not being on straight because you had a wreck last week," Tim notes, "they won't overlook anything that involves safety. With safety, it's either got to be there, or you don't get to race. You might as well stay home."

But Tim Williamson isn't staying home—he's going racing—fast.

THAT SMARTS!

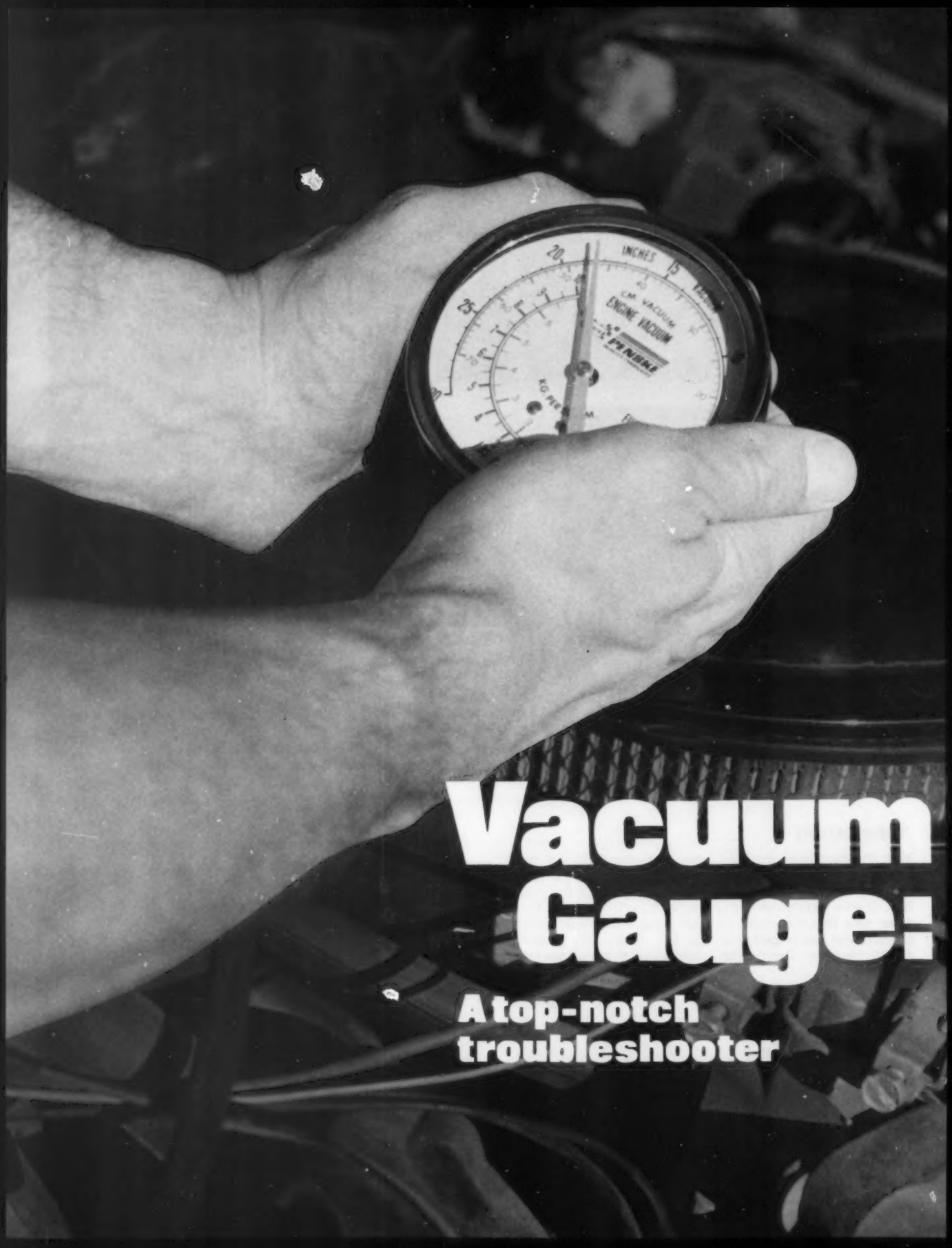
Somebody in the Grand American qualifying session before Tim Williamson went out, blew an engine and dropped oil leading into Ontario's turn three at the end of the back straightaway. Tim's car hit the oil and started to spin around. "I wanted to get it all the way around so I could miss the wall," Tim recalls, "but the wall caught it and pushed the corner down. It looks worse than it is—mostly it's body damage." In the other picture you can see how the fuel tank was ripped open, exposing the fuel bladder. Even if the bladder had been punctured, gasoline wouldn't have leaked out because there is foam inside to reseal any holes that develop. All in the name of safety.

Tim's love for fast driving is reflected in final results. Here he collects a trophy and a new helmet for being the "fastest of the fastest" in a three-lap trophy dash.



TIRESOME

With the four tires that are on the car this is enough rubber to last a 500-mile race. If it seems excessive consider how much racing tire development has helped your street machine. During the first Darlington 500 in 1950, tires were very much like those on street cars of that day. If they lasted 50 miles before blowing out the drivers were lucky. In fact the tire graveyard at the end of the race looked like somebody had made a mountain out of a rubber tree plant. That day the winner averaged 76 mph. Today's racing tires don't blow out as such because they have a safety inner liner tire. This same type of liner is available for your car tires. However, at the same time, most street tires don't blow out either—they just slowly go flat. Also today's racing tires will last anywhere from 100 to 150 miles of sustained high speed easily—this is another factor which has been carried over into modern highway tires. By the way, the fastest Darlington 500 ever run was won with a 134 mph average speed. Besides, street tires probably wouldn't last a single lap at today's racing speeds—at that rate it would take a thousand or so skins for a 500-mile race.



Vacuum Gauge:

A top-notch troubleshooter

The Backyard Mechanic

In these days of multi-thousand-dollar electronic test equipment it is reassuring to know that there is still a $10 instrument that can help the backyard mechanic diagnose more than 30 different engine problems – the vacuum gauge. This top-notch troubleshooter is quick to diagnose anything from sticking valves to poor rings, including bad carburetor adjustments and a leaky head gasket.

For the economy-minded motorist, the vacuum gauge can squeeze more mileage out of every gasoline drop than a politician can get from a campaign promise. In addition, the gauge can be employed to check the positive crankcase ventilation valve and system – a big plus for ecology.

(left)
Although this backyard mechanic is holding this vacuum gauge as if it were a multi-thousand-dollar test instrument, it is actually a $10 tool that can help diagnose more than 30 engine problems.

If this sounds like a lot to expect from such a simple, inexpensive device, it is not. Especially when considering that vacuum is essential to engine operations. The vacuum is created by each cylinder as the piston goes down on its intake stroke. When the intake valve opens drawing a fresh fuel charge from the intake manifold, a vacuum is created in the intake manifold. When the engine is operating properly, there is a steady, constant vacuum at idle, as each cylinder smoothly and efficiently draws its fuel charge. But any malfunction or misadjustment which affects engine efficiency also alters this vacuum. Since specific engine problems affect manifold vacuum in certain ways, a vacuum gauge can be used to accurately diagnose the condition of an engine by measuring the amount and condition of vacuum.

To provide this measure and condition report, the vacuum gauge must be hooked up correctly. You can't just pull a vacuum line and attach the instrument. Accurate, reliable readings can be obtained only from primary manifold vacuum sources. For best results follow the gauge manufacturer's recommendations – you know, "when all else fails, read the instructions."

On older vehicles with vacuum-operated windshield wipers, remove the wiper system vacuum hose at the intake manifold and attach the gauge hose. Many vehicles have a threaded plug in the manifold that can be removed and a special fitting installed. This fitting is usually supplied with the gauge, although parts suppliers can provide them when they are not or when a different size is needed. If there isn't a plug in the manifold, then install a T-fitting in the vacuum line to the power brake unit or vacuum assist on disk brake-equipped cars.

For best results, always attach the gauge as close to the vacuum source as possible.

First do a cranking vacuum test. After starting the engine and warming it to normal operating temperature, shut it down. Remove the high-tension coil lead from the distributor cap and connect it to a good ground. Remove the air filter. Back out (turn counterclockwise) the idle speed screw until the throttle plate closes tightly. If the carburetor is old enough to still have idle speed air screws, turn them in until they bottom or hit the limiter caps. Remember, when turning any adjustment screws, count the number of turns so that they can be returned to original positions. If your carburetor has an anti-dieseling solenoid, disconnect it. Remove the PCV valve at the engine rocker arm cover or push rod cover and plug it with tape.

Cranking the engine will give you an easy engine diagnosis in inches of mercury. The healthy emission-controlled engine will give a steady reading of 4 units or more, while the non-emission-controlled (pre 1968) engine will read at a steady 10 units or more. While readings may vary considerably between power plants, they should not fall below these minimums.

An excessively low vacuum reading that is steady is caused by a condition that affects all cylinders equally. Numerous causes for this include: a carburetor flange gasket that is leaking; a worn carburetor throttle shaft; leaking vacuum lines; improper valve timing, or a slow cranking engine. The slow engine cranking can be due to a run-down battery, excessive resistance in the battery cable connections, a defective starter or excessive mechanical drag from tight-fitting pistons in a recently rebuilt engine or oil thickened by excessive oxidation.

While even pulsing is normal for 6- and 4-cylinder engines, uneven pulses indicates a leaky condition that is not affecting all the cylinders. Such conditions include: burned or stuck valves; an intake manifold leak at one cylinder; worn intake valve guide, or a broken piston or ring.

Now remove the tape covering the PCV valve. If it is operating properly the vacuum will drop to about half its original value. If it drops to less than one-half, there is excessive flow which may upset the air/fuel ratio, causing rough idling or even burned valves. No change indicates a clogged PCV valve.

OK, put everything back the way it was before we started the cranking test. This includes returning the idle screw to its original position; replacing the coil high tension wire; reconnecting the anti-dieseling solenoid; reinstalling hoses and vacuum lines, and putting the PCV valve back into the PCV system.

With the engine warmed to operating temperature, set the idle to specifications. The idle must be correct since open throttle plates drop the vacuum, affecting the accuracy of the readings. With the engine running at idle you have an instantaneous engine evaluation.

Again, the healthy engine will give a steady, constant reading. However, as the engine is running, the reading should be between 17 and 22 units, although some newer 4- and 6-cylinder models deliver acceptable performance at 15 inches. Also, a slight flicker of the needle can be expected with high-performance engines. There is a drop of one inch for each 1,000 feet above sea level.

The engine that gives a steady vacuum reading at idle, with the needle dropping toward zero and jumping back past 20 when the throttle is opened

and closed quickly, is in good condition. Anything else spells trouble.

If the needle swings back and forth slowly, the engine is speeding up and slowing down. The carburetor is probably causing this although air leaks might be indicated.

After checking the carburetor base gasket, tighten all the nuts holding the carburetor to the manifold and manifold to the engine block. Now turn the low-speed mixture adjusting screws in (clockwise) until the vacuum drops two or more divisions, or you hit the stops. Then turn the screws out (counterclockwise) until the gauge reaches the highest obtainable value. If the needle still swings, look higher in the system. If the air cleaner isn't clogged, bend the float level down 1/16 inch. Still no improvement? Has the carburetor served 30,000 to 40,000 miles or more? If so, it's time to look into a new or rebuilt model.

Is the needle reading steady, but below acceptable ranges? This means the throttle is open wider than necessary. Why? Is the engine new and stiff? Maybe it isn't completely warmed and the oil is thick. Maybe the ignition timing is late. Or the valve and ignition timing are late as the result of worn timing gears or timing chain.

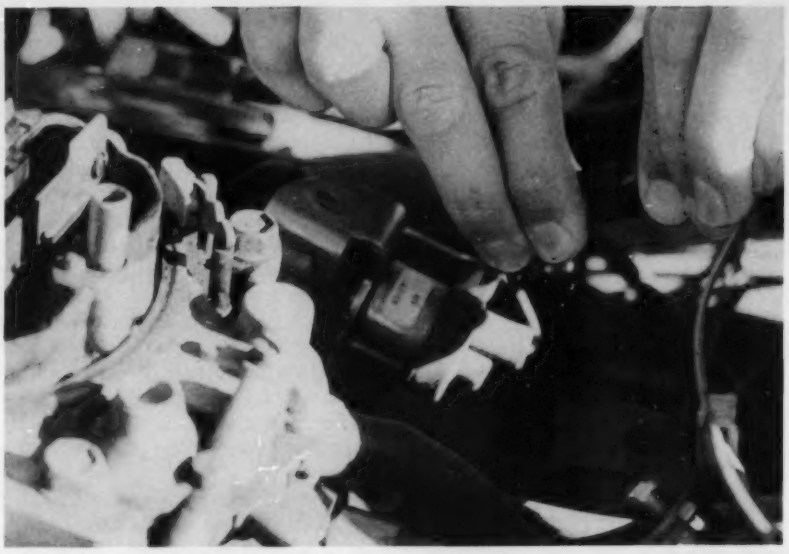
Leaking intake valve, burned distributor contact points, blown head gasket or a totally dead cylinder will cause considerable pulsation at a steady rate.

Now open and close the throttle suddenly. If the needle dropped to zero and then shot up between 20 and 22, chances are you need new rings.

A pointer which sweeps or wanders erratically through several inches indicates a malfunction affecting all cylinders unequally and inconsistently. To help isolate the trouble, run the engine at about 2,000 rpm. If the pointer steadies, check ignition and timing, then carburetor mixture adjustment. Should the sweeps get larger, check for weak or broken valve springs. Shorter and more rapid sweeps call for an induction system leak check or even checking for sticky valves.

If the reading is very low, advance the timing.

Is the vacuum gauge oscillating in range of one or two points? Could be the spark plug gaps are too close.

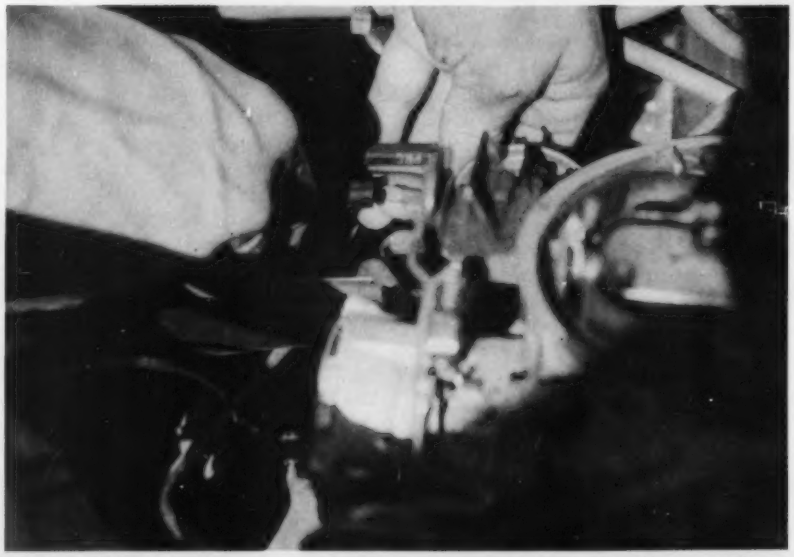


When disconnecting items to conduct the cranking test, don't forget to unplug the carburetor anti-dieseling solenoid.

If you run the engine at a steady 2,000 rpm and the gauge gradually reduces to almost zero and begins to climb slowly, you may have an exhaust system restriction.

Although it is an excellent diagnostic tool, especially when used in conjunction with a compression gauge, the vacuum gauge's real value comes with more frequent use. By making regular vacuum checks you can spot developing problems and correct them before they become major disasters.

The best way to keep constant tabs on the engine's performance is to install a permanent dash-mounted vacuum



Finding a line to hook the vacuum gauge hose into may be the most difficult operation in this entire testing series. Accurate, reliable readings can only be obtained from primary manifold vacuum sources.

Sealing the positive crankcase ventilation valve before beginning the cranking test will provide a method of checking the PCV valve's operation in the next step.

gauge. These are often sold at auto supply and discount stores as "motor monitors." Since they are usually calibrated in fuel economy ranges, they will help get the most out of every drop of fuel as well as give you a complete engine anlaysis at a glance. Fuel economy ranges relate to throttle plate openings. The higher the vacuum reading, the narrower the throttle plate opening, therefore the higher the fuel economy,

While the vacuum gauge can't remedy the faults it finds, it does simplify the job. It can save you money, contribute to a better environment and deliver the peace of mind you get with a smooth-running, efficient vehicle.

Healthy engines give steady, constant readings between 17 and 22 inches of mercury, although some newer 4- and 6-cylinder models deliver acceptable performance at 15 units.

tack it UP

- Anytime you are working on a vehicle, read the instructions that came from the manufacturers of everything you are using as well as the service or shop manual covering the job at hand.
- Set the parking brake. Put the transmission in neutral or, on automatic transmission, park.
- Always operate the vehicle in a well-ventilated area to avoid carbon monoxide asphyxiation. If the area can't be ventilated, route the exhaust outside via a leak-proof exhaust hose.
- Keep hands, hair, neckties, loose clothes and test leads well away from fan blades, fan belt, power steering belt, air conditioner belt and other moving engine parts.
- Don't touch hot exhaust manifold, radiator, or high-voltage spark plug and coil terminals.
- Never look into a carburetor throat while the engine is being cranked or running. Sudden backfires cause burns.
- Don't smoke or allow flame or spark to occur near carburetor, fuel line, fuel filter, fuel pump, spilled gasoline, clean solvents and other flamables. Be especially cautious of using anything electrical within 18 inches of the floor to avoid igniting gasoline vapors.
- Never use gasoline as a cleaning solvent.
- Keep a fire extinguisher rated for gasoline and electrical fires handy.
- Use the proper tool of the proper size for every job.
- Think what is going to happen should your hand slip when working with a tight bolt or nut.
- Don't use worn tools.
- Think positive. Negative thinking and talking—such as cussing after you've already had one painful experience—only lead to more pain.

ATTENTION, amateur HUMORISTS!

Here's your chance to make that first vital step toward a rewarding career as a joke writer! Just write a caption for the photo you see on these pages and send it to us at:

DRIVER Magazine
HQ AFISC/SEDD
Norton AFB, CA 92409

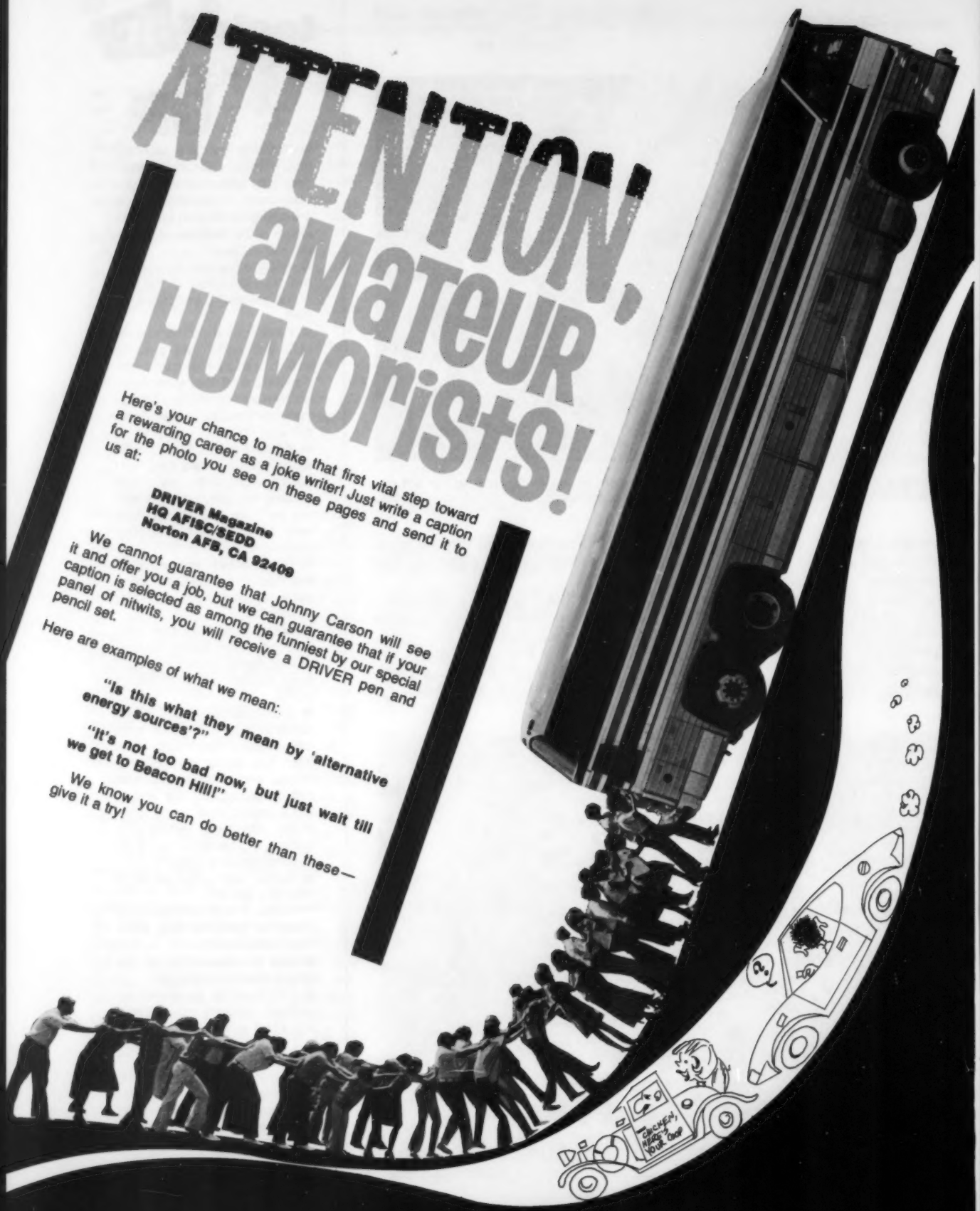
We cannot guarantee that Johnny Carson will see it and offer you a job, but we can guarantee that if your caption is selected as among the funniest by our special panel of nitwits, you will receive a DRIVER pen and pencil set.

Here are examples of what we mean:

"Is this what they mean by 'alternative energy sources'?"

"It's not too bad now, but just wait till we get to Beacon Hill!"

We know you can do better than these— give it a try!



Timely Topics

CORRECT TIRE PRESSURE

Nearly every driver now knows that proper air pressure adds to tire life. But what is the correct pressure for the tires on your car? On most cars, recommended tire pressures for normal day-to-day driving are indicated on a sticker affixed to the glove compartment door or on the left front door or door post. Higher pressures are recommended for extended highway driving to get better gas mileage, but cold pressure should not exceed the maximum marked on the tire sidewall. Any difference specified by the car manufacturer between the front and rear tires should always be maintained.

RUN AIR CONDITIONING IN WINTER

It may sound strange, but you should run your car's air conditioning system about once a month during the wintertime, advises the Automotive Information Council (AIC).

If you don't, the seals—especially the one for the compressor shaft—can begin to leak freon. Freon is the chemical gas which is the refrigerant.

Running the air conditioner periodically for about five minutes each time will lubricate the seals and other internal parts and keep the system operational until warm weather returns. It therefore is obvious that the compressor drive belts should not be removed during the winter.

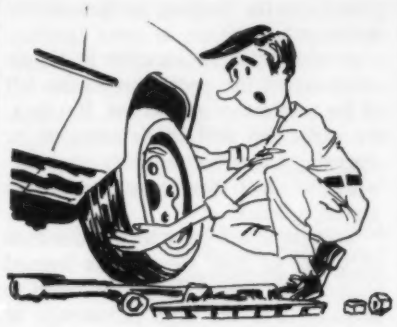
The level of freon also should be checked to see that the system is properly charged. This should be done not only now but again in the spring.

Most units have a small inspection glass installed on a line leading to the evaporator. The glass often is difficult to spot because of oil and grime covering it, so clean off the line with a cloth. With the air-conditioner operating at fast idle, check the sight glass and if there is a continual stream of cloudy bubbles you can assume that the system needs a charge of freon.

Freon should be handled only by people who are trained to do it. DRIVER does not recommend servicing the system yourself unless you have been through a training class.

DON'T ROTATE FRONT-WHEEL-DRIVE TIRES

Owners of front-wheel-drive cars are advised not to rotate their tires. Goodyear tests indicate that rear tires, because of their lighter load and free-rolling function, simply loaf along and tend to wear much longer, up to nearly 100,000 miles. When new tires are purchased they should be placed on the front, and the rears probably will last the life of the car, the company said.



THE ODDS AGAINST YOU

Want to guess your chances of having a car accident this year? One in a hundred, or one in fifty? . . . Both answers are far too optimistic. *The fact is that one in every five American drivers is involved in an automobile accident every year.* . . . It's the day-to-day driving that gets you, too. Three out of every four crashes that result in deaths occur within 25 miles from home. Moral: Wear your seatbelt, *all* the time. . . .

FREE CONSUMER CATALOG

By the time you receive this issue of DRIVER the General Services Administration will have a new edition of its handy Consumer Information Catalog available. This is a free, 16-page listing of the best consumer publications from the government. The catalog contains information on over 200 booklets you can order, from planning a budget to car care and maximizing fuel economy—including our own "Backyard Mechanic," Volumes I and II. To get a copy of the catalog, just send a postcard with your name and address to: Consumer Information Catalog, Pueblo, Colorado 81009. You'll receive your copy in about three weeks.

SUBCOMPACTS ON ICE

Driving a subcompact car in winter is a case of "some good news and some bad news," according to the Safe Winter Driving League. The good news is the subcompact will stop in a shorter distance on ice than a compact, which will stop shorter than a standard-sized model. The bad news is the small cars can't get started as easily on ice, because they are lighter and develop less breakaway traction. However, once the three sizes of cars get moving, there is little difference in their traction capabilities.

These results are based on tests of rear-drive cars performed by the National Safety Council's Committee on Winter Driving Hazards.

CHP DUI CAMPAIGN

In December, the California Highway Patrol ran a campaign for the holiday season against drinking drivers. The state's Office of Traffic Safety provided nearly half a million dollars toward increased enforcement hours and an awareness campaign. Part of the campaign was the symbol shown here, the letters "DUI" covered by a circle and diagonal slash and the words "No driving under the influence." This was posted on billboards, and also appeared on matchbooks, bus cards, pins and other items. The CHP said, "We think (the symbol) will outlast the campaign, becoming a standard symbol to indicate that driving under the influence is improper behavior."

SPIN AWAY A 1,000 MILES

What's the most important factor in maximizing tire life? According to Goodyear radial tire engineering manager Tom Ford it's the driver. For example, one screeching, tire-spinning start can grind away up to 1,000 miles of tread life.

Other tread-wear factors include: road texture, hills, curves, average temperatures, weather, speed, braking, load, inflation and rotation. The classic case is Hawaii where tires wear unusually quick because very abrasive lava is used in road construction.

LETTERS to the EDITOR

BACKfire

PEDESTRIAN TRAVEL

Your article in the September DRIVER on cyclists was exceptionally fine. I am associated with a bicycle club and although we should "know all about it" there is always need for review.

The article brought a question up in the group regarding pedestrian travel. The group was almost evenly divided about going with and going against traffic. As you noted in the article, there are "authorities" quoted frequently. Would it be possible to address this area in a subsequent issue? Can you direct me to a reliable source of information that may be used to determine what is correct?

CDR W.E. Reutter, USNR
Naval Security Group Command Hqtrs
3801 Nebraska Avenue, N.W.
Washington, DC 20390

For an "authority" about the proper direction of pedestrian travel, check your municipal and state laws. More than half the states require a pedestrian walking along a roadway where sidewalks are not provided to walk on the left side of the roadway or its shoulder.

In the Air Force we pattern our base traffic codes after the Uniform Vehicle Code (as well as assimilating host-state laws). Article 11.506 of the Code requires: (a) if sidewalks are available it is unlawful to walk along on the roadway; (b) with no sidewalk, pedestrians shall, when practical, walk only on the left side facing traffic.

MOTORCYCLE BRAKING SYTEMS

Your article on the Hurt Study was interesting; however, your comment on deficiencies in motorcycle braking systems was somewhat off base and totally out of place in DRIVER!

If most motorcyclists in the study over-braked the rear wheel and under-braked the front it is the fault of the rider, not the braking system of the motorcycle.

Admittedly, it is not quite as simple as stomping the pedal just to the left of the accelerator in your car. But then, the skills and skill levels required for operating a motorcycle safely are somewhat different than those needed for aiming a Buick.

Wouldn't this lead to the question of where or how these riders learned their riding skills? What you failed to mention was the high percentage of motorcyclists who had no formal training, as pointed out in the Hurt Study.

As a motorcycle safety instructor I have been involved in teaching this skill (braking). It's important for a rider to learn the best way of stopping through a good motorcycle riding class. Most of the riders I have instructed have learned from a buddy who told them that using the front brake would throw you over the handlebars every time! Not true.

The use of safety devices to protect ourselves in accidents is just fine. I would prefer to use an approach with a little more foresight. As a car or motorcycle is really only as safe as its operator, it makes more sense to train the operator to avoid accidents. Isn't that what developing high operator skill levels and in essence, defensive driving, is all about? Automatic restraint systems, 5 mph bumpers, motorcycle safety helmets and other protection devices are not a cure for poor driver performance.

PR2 Bruce Davidson, USNR-TAR
AIMD
NAS Atlanta
Marietta, GA 30060

The current philosophy in the civilian world seems to be: Design the machinery so that the operator doesn't need expensive training. If you operate under this philosophy, then motorcycle braking is deficient because the untrained rider underbrakes the front wheel because he's afraid he'll go over the handlebars.

GAS GUZZLING

Carol Clewley did a great piece of writing in your November issue, but in this age of scarce supply of petroleum products, how can Ms. Clewley justify the great fun with gas-guzzling four-wheel-drive vehicles? I suggest she and her friends take up hiking, bicycling and jogging. After all, they could put spikes in the bicycle tires if they need ice racing.

Mr. Tom Wilden, USAF
Route 7, Box 135
Columbus, MS 39701

DRINKING DRIVERS

Although I usually do not write editorial comments, I found a small article in your October issue that sparked interest and concern both as an AF member and as a civilian vehicle operator. The article deals with the conviction intervals between DWI convictions.

When will the Federal government do something? Over half of all the motor vehicle accidents (fatalities) can be attributed to the drinking driver. We have tried scare tactics, then we tried educating family members and friends. How much more will it take till they awaken to the facts? Maybe if the civilians were exposed to the same sometimes costly and extreme penalties as we in the military are, there would be fewer deaths.

As a safety technician I am perhaps exposed to more of this than are some others and don't get me wrong, I am not against drinking nor am I against

driving. However, when the two are mixed it has been proven that they are in fact a deadly combination. Maybe if the government would stop and look at the monetary gains and loss of suffering that could result from more harsh penalties they would impose something like this: Mandatory 1-year revocation of privileges upon conviction; Mandatory 2-year revocation for second conviction; Mandatory life revocation for third conviction. Also make it more than a traffic offense to be caught while driving while your license is revoked for DWI.

Maybe with some laws like these there would be less needless slaughter and suffering.

SSgt Wayne S. Woodell, USAF
90 SMW/SE
F.E. Warren AFB, WY 82001

AEROSOL PAINT CAN EXPLOSION

A potentially catastrophic accident was narrowly averted recently when a full aerosol can of paint exploded on the rear flooring of a Volkswagen Beetle.

The explosion occurred at 55 mph and blew a cloud of white paint throughout the interior of the vehicle. The force of the explosion, and the effects of the shrapnel damaged the back of the right front seat, but did not injure the driver. At the time of the explosion, the car engine also quit.

The driver, operating in a white-out condition with simultaneous engine failure, managed to remain in control of the vehicle and coasted to a safe stop on the road shoulder.

Investigation revealed that the paint can had rolled against an operating and open heater floor vent and exploded due to the generated engine heat.

I have taken the necessary steps, within my unit, to insure that this problem does not happen again, but would recommend that other units consider addressing the dangers of transporting aerosol cans in passenger compartments of vehicles, or storage of same in areas of moderate heat concentrations.

Fortunately, we lost only the paint can and one pair of jockey shorts—but it could have been much worse.

CM3 James M. Carlozzi, USA
Safety Technician
4th/498th Med Co (Air Amb)
Fort Jackson, SC 29207

A GREAT IDEA!

For years now various sources, including TV have encouraged vehicle owners to keep plastic antifreeze bottles, plastic one-gallon milk containers, etc., and use them for waste oil following changing your vehicle oil. Have you experienced the same problems I have—spilling the oil on your garage floor trying to pour it from the catch pan into one of these containers?

I've found a good solution. Take one of the new 2 litre plastic soft drink bottles, cut the bottle approximately three inches down from the neck and use the top portion as a funnel. These bottles have a large ring around the neck just below the cap which prevents the funnel from going too far into the container. Result: No more spilling oil on the floor.

Maj Richard W. Covey, USAF, MSC
2402 North Leighton Circle
Wichita Falls, TX 76309

Great idea Major Covey. The technical editor saw another use for the bottle top sections while doing the Mike Kidd story. Motorcycle dirt riders cut sections out of the tops after removing them from the bottles and place them over the handlebars in front of the grips to protect their hands. Although dirt's not as messy as oil, it hurts more when propelled off tires of the bike in front of you—a real safety hazard if we ever saw one.

KUDOS

Procrastination is my greatest sin
It brings on needless sorrow
I really must stop doing it
By George, I'll start tomorrow.

(Anonymous)

Intended to tell you long ago how much I enjoy your magazine. It's one of the BEST. Keep up the good work. Three cheers for our terrific Air Force.

Ms. J.K. Adcock
MTMC Baltimore Outport
Dundalk Marine Terminal
Baltimore, MD 21222

PLAUDITS

I just read your magazine for the first time, and I must say I am very impressed. As I am involved in the training of emergency vehicle operators throughout the State of Oklahoma and other areas, I find your publication very informative and well constructed. I believe in utilizing every possible resource in maintaining a high standard of training as the importance of training emergency vehicle operators becomes more recognized. Again, I feel that your magazine will be of great benefit to my training program.

Mr. Gary McGraw
Emergency Driving Instructor
AMCARE
2409 North Broadway
Oklahoma City, OK 73103

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ONE out of FOUR

When you come to a flashing red light at an intersection, you know you must stop. But what do you expect the cross-street traffic to do?

If the cross traffic has a flashing yellow light it need NOT stop. But a lot of people are confused. *Car and Driver* recently reported that more than a quarter of the drivers questioned in metropolitan areas (28% of drivers to be exact) thought that when they faced a flashing red, the cross-traffic—those faced with the flashing yellow—would also have to stop.

Think about that. One out of every four times you motor up to a flashing-red-and-yellow intersection on the yellow with a car approaching at a right angle on the red, the driver of that car expects YOU to full-stop, too.

Many intersections are switching to flashers in off-peak hours to conserve gasoline. Accidents have more than doubled at such intersections.

When you have the flashing yellow, remember CAUTION.

NOTE: Flashing lights can have completely different meanings outside the United States. Know your local traffic rules.